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Solution by the PROPOSER.

Let P be the atmospheric pressure. Then the pressure at the first surface of separation is $P+g\sigma_1[x_1^2-(x_1-a)^2]/8a$.

Similarly at the second or free surface, $P+g\{\sigma_1[x_1^2-(x_1-a)^2]+\sigma_2[(x_1-a)^2-(x_1-2a)^2]\}/8a$.

$\therefore\ P=P+g\{\sigma_1[x_1^2-(x_1-a)^2]+\sigma_2[(x_1-a)^2-(x_1-2a)^2]\}/8a$.

$\therefore\ 2x_1(\sigma_1+\sigma_2)=a(\sigma_1+3\sigma_2)$.

Similarly $P=P+g\{\sigma_2[x_2^2-(x_2-a)^2]+\sigma_1[(x_2-a)^2-(x_2-2a)^2]\}/8a$.

$2x_2(\sigma_1+\sigma_2)=a(3\sigma_1+\sigma_2)$.

63. Proposed by F. M. SHIELDS, County Surveyor, Coopwood, Miss.

Of three chronometers, A, B, and C, A keeps true time; B gains 5 minutes and $15\frac{3}{4}$ seconds a day by true time, and C loses 7 minutes and $15\frac{3}{7}$ seconds a day by true time. The hands of all three watches are set at 12 noon on a certain day. What is the time by the true watch, A, on the *fifth* day after the time when the hands of the fast watch, B, point to 12, and what is the time by the true watch, A, on the *tenth* day after the time when the hands of the slow watch, C, point to 12?

I. Solution by J. H. DRUMMOND, LL. D., Portland, Me.

B goes $1445\frac{21}{80}$ minutes while A goes 1440; then $1445\frac{21}{80} : 1440 :: 5 :$ 4d. 23h. $33\frac{90567}{115621}$m., and the answer is $33\frac{90567}{115621}$ minutes past eleven.

C goes $1432\frac{26}{35}$ while A goes 1440; hence $1432\frac{26}{35} : 1440 :: 10 :$ 10d. 1h. $12\frac{23544}{25073}$m., and the answer is $12\frac{23544}{25073}$ minutes past one.

II. Solution by ALOIS F. KOVARIK, Instructor in Mathematics and Physics, Decorah Institute, Decorah, Ia.

While the watch A goes 24 hours, or 1440 minutes, the watch B goes 1445 minutes, $15\frac{3}{4}$ seconds, or $1445\frac{21}{80}$ minutes. To find how much the watch A is behind B at the end of 24 hours *by* B, we find 1 minute of B equal to $1445\div1445\frac{21}{80}$ of A's, and 1440 minutes of B's$=1440\div1445\frac{21}{80}=1434\frac{87486}{115621}$, *i. e.* when the hands of the watch B point to 12 at the end of the first 24 hours *by* B, the watch A lacks $5\frac{28135}{115621}$ minutes. On the *fifth* day after time when the hands of the watch B point to 12, the watch A lacks $5\frac{28135}{115621}\times5=26\frac{25054}{115621}$ minutes to 12.

At the end of the first 24 hours *by* C the watch A is $7\frac{7369}{25073}$ past 12. On the tenth day after time when the hands of the slow watch C point to 12, the time by the true watch A is $7\frac{7369}{25073}\times10=72\frac{23544}{25073}$ minutes, or 1 hour, $12\frac{23544}{25073}$ minutes past 12.

III. Solution by P. S. BERG, A. M., Principal of Schools, Larimore, N. D.

24 hours, 5 minutes and $15\frac{3}{4}$ seconds on chronometer B equals 24 hours on chronometer A. Hence 5 days on B equals 4 days, 23 hours, 33 minutes and 46.9 seconds on A. Therefore the time by the true watch A is 11 hours, 33 minutes, and 46.9 seconds A. M. on the fifth day.

$1432\frac{26}{35}$ minutes on chronometer C equals 1440 minutes on chronometer A.

Hence ten days on chronometer C equals 10 days, 1 hour, 12 minutes and 55 seconds on chronometer A. Therefore the time by the true watch A is 12 minutes, 55 seconds past 1 P. M. on the tenth day.

Also solved by *CHARLES C. CROSS*, and *G. B. M. ZERR*.

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PROBLEMS FOR SOLUTION.

ALGEBRA.

90. Proposed by J. MARCUS BOORMAN, Consultative Mechanician and Counselor at Law, Woodmere, Long Island, N. Y.

Fully solve $x^2+y^2+m(x+y)=m^2$......(I); $x^2+y^2+xy=m^2$......(II); give process, roots, and corollary. [Solved *in part*, *Cirode's Algebra*, *page* 202.]

91. Proposed by NELSON S. RORAY, Professor of Mathematics, South Jersey Institute, Bridgeton, N. J.

Solve the following without making use of the determinant notation and prove that the results obtained are the roots.

$$10x-2y+4z=5,$$
$$3x+5y-3z=7,$$
$$x+3y-2z=2.$$

92. Proposed by W. F. BRADBURY, A. M., Head Master Latin School, Cambridge, Mass.

Find the sum to n terms of $1+3^3+5^3+\ldots\ldots$ [From *Charles Smith's Elementary Algebra*, page 403.]

⁂ Solutions of these problems should be sent to J. M. Colaw not later than December 10.

GEOMETRY.

105. Proposed by B. F. FINKEL, A. M., M.Sc., Professor of Mathematics and Physics, Drury College, Springfield, Mo.

Sind A, B, C, D vier harmonische Punkte und beschreibt man über dem Durchmesser AC einen Kreis, von welchem S ein beliebiger Punkt ist, so wird derjenige Kreisbogen, welcher innerhalb des Winkels BSD liegt, entweder von A order von O Strecke PB halbirt. [*Reye's Geometrie der Lage*, page 191.]

106. Proposed by C. HORNUNG, A. M., Professor of Mathematics, Heidelberg University, Tiffin, Ohio.

Upon the sides of any triangle ABC let the equilateral triangles ABD, BCE, and CAF be described, and let their exterior sides produced intersect, BE and AF in K, DB and FC in L, and DA and EC in M. Prove DK, EL, FM, parallel.

107. Proposed by T. W. PALMER, A. M., Professor of Mathematics, University of Alabama.

Construct a triangle, given base, vertical angle and radius of inscribed circle.

⁂ Solutions of these problems should be sent to B. F. Finkel not later than December 10.